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DEPARTMENT OF REGISTRATION AND EDUCATION

MINERAL RESOURCES AND MINERAL INDUSTRIES OF THE SOUTHEASTERN ILLINOIS REGION

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MINERAL RESOURCES AND MINERAL INDUSTRIES OF THE SOUTHEASTERN ILLINOIS REGION

Robert L. Major

ABSTRACT

The mineral resources and the mineral extraction and processing facilities of the Southeastern Illinois Region are described and discussed in this report. The Southeastern Illinois Region includes 27 counties—Bond, Clark, Clay, Clinton, Crawford, Cumberland, Edwards, Effingham, Fayette, Franklin, Gallatin, Hamilton, Jackson, Jasper, Jefferson, Lawrence, Marion, Perry, Randolph, Richland, Saline, Shelby, Wabash, Washington, Wayne, White, and Williamson. The region is the most important minerals district in Illinois, having produced $308 million worth of mineral products in 1964, or about 50 percent of the state's total for the year.

The region accounts for 95 percent of the crude oil and 50 percent of the coal produced in Illinois. Other minerals produced in 1964, in order of their value, were crushed and broken limestone, clay products, gravel, gas, and sand. Mineral processing facilities in the region include two secondary zinc smelters and two crude oil refineries.

INTRODUCTION

This report is the third in a series of eight concerning Illinois mineral resources and related mineral industries. The series is being prepared by the Mineral Economics Group, with the assistance of staff members in other sections of the Illinois State Geological Survey. Each report considers one particular region of the state, and this one covers the Southeastern Illinois Region (fig. 1). The region comprises 27 counties—Bond, Clark, Clay, Clinton, Crawford, Cumberland, Edwards, Effingham, Fayette, Franklin, Gallatin, Hamilton, Jackson, Jasper, Jefferson, Lawrence, Marion, Perry, Randolph, Richland, Saline, Shelby, Wabash, Washington, Wayne, White, and Williamson. Extreme southern Illinois was covered in Mineral Economics Brief 13 and the Illinois portion of the Greater St. Louis Metropolitan area in Mineral Economics Brief 12.

The Southeastern Illinois Region is of great importance to the economy of the state as it is the prime mineral-producing area. Its relative importance as a producer of various mineral commodities from 1954 to 1964 is shown in

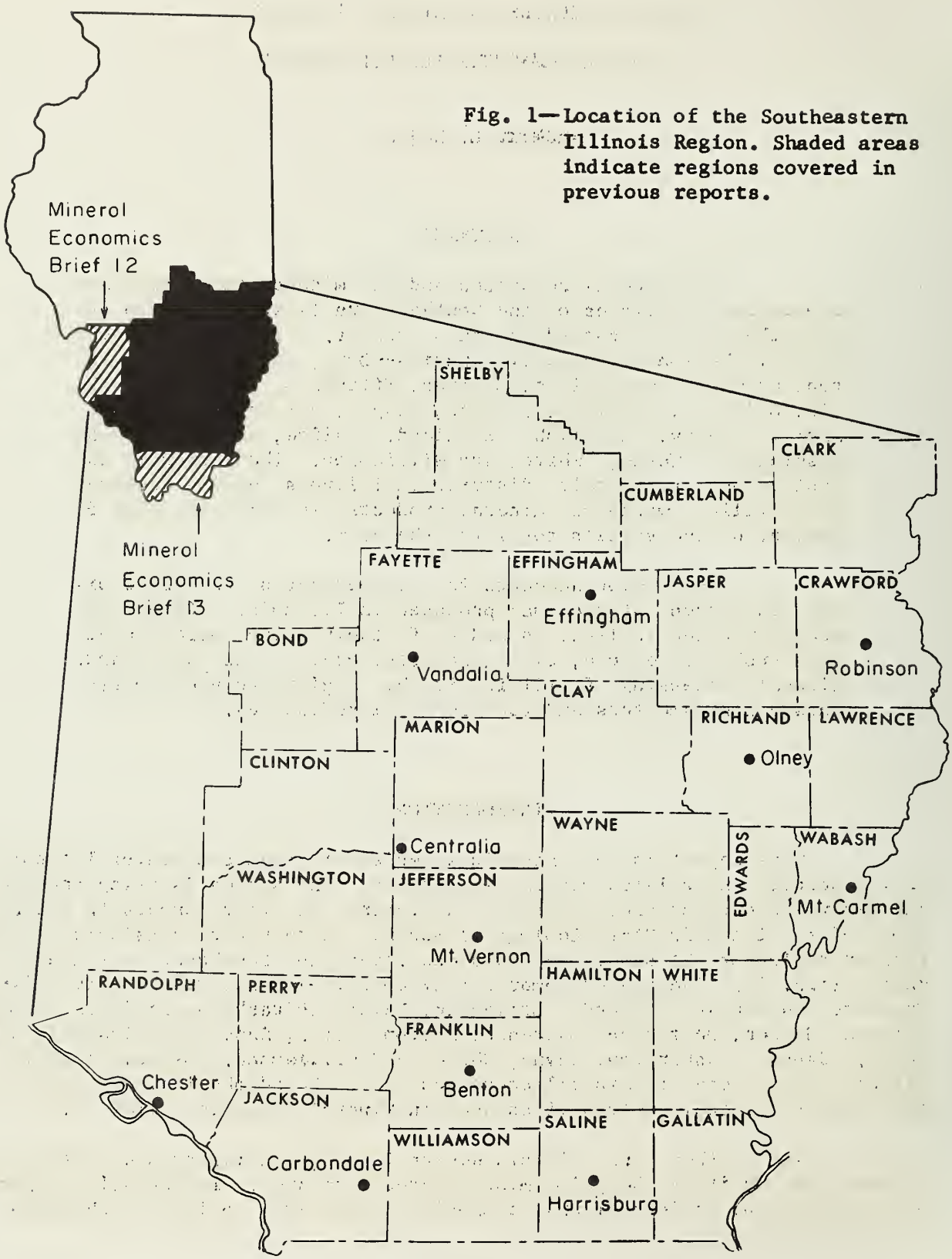


Fig. 1—Location of the Southeastern Illinois Region. Shaded areas indicate regions covered in previous reports.

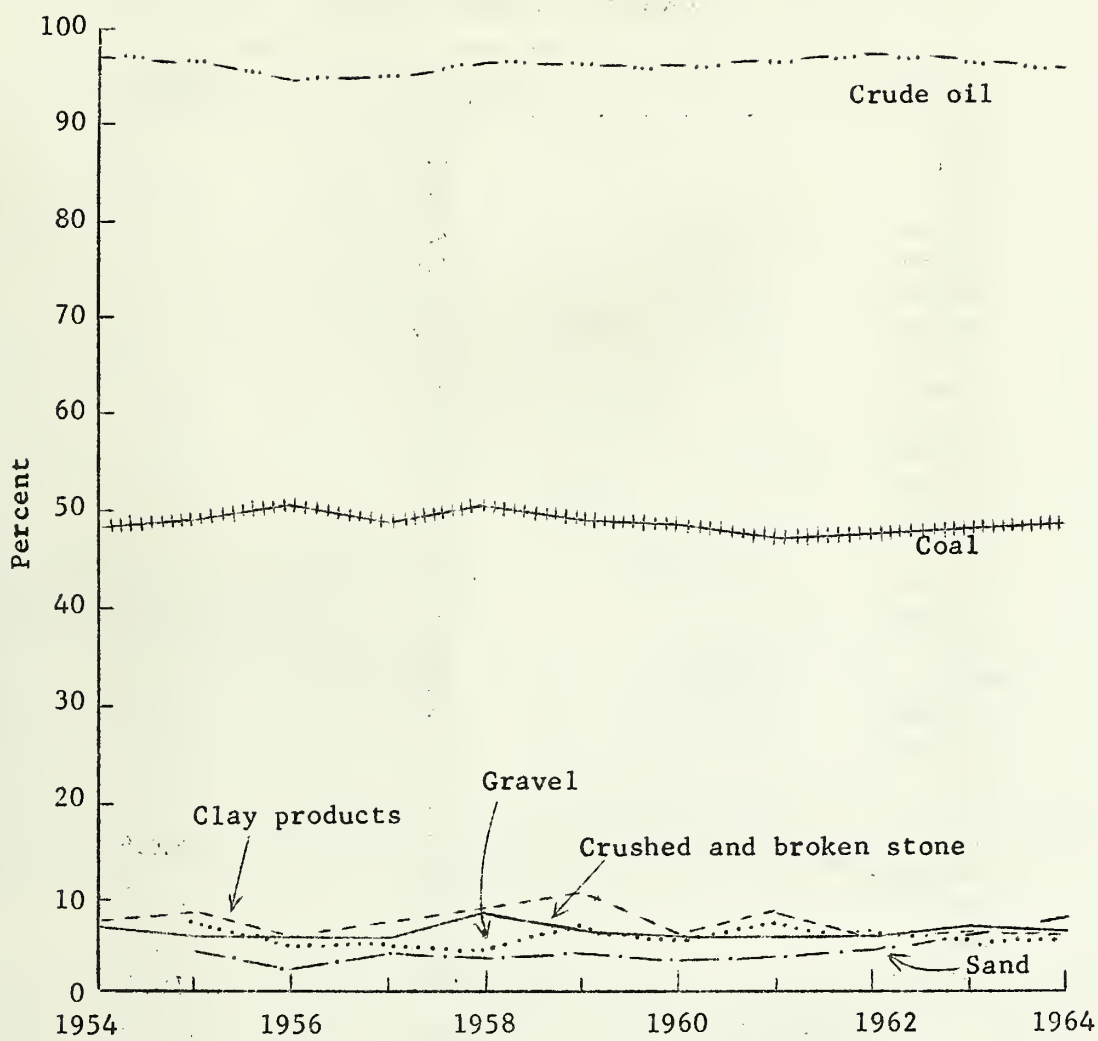


Fig. 2—Mineral production of the Southeastern Illinois Region shown as a percentage of the total Illinois production for each commodity.

figure 2, which indicates that the region accounted for more than 90 percent of the crude oil production, about 50 percent of the coal production, and 10 percent or less of sand, gravel, clay products, and crushed and broken stone. Table 1 gives a breakdown by county of the payroll and the number of employees for the mineral industries of the Southeastern Illinois Region. Directly employed were 13,584 persons, accounting for a payroll of $64.8 million in 1958. Almost half of the payroll and employment in the mineral extraction and processing industries for the state of Illinois is concentrated in this region.

The mineral production value for the region (table 2) was $316.8 million in 1963 and $307.6 million in 1964, or 51.5 and 49.8 percent, respectively, of the state total for each of the two years. The six main commodities produced in the Southeastern Illinois Region in 1964, in order of their value, were crude oil, coal, crushed and broken limestone, clay products, gravel, gas (natural and L.P.G.—liquefied petroleum gas), and sand.

TABLE 1 - EMPLOYMENT AND PAYROLL OF THE MINERAL INDUSTRIES OF THE SOUTHEASTERN ILLINOIS REGION*

County	Employees	Payroll ($1000)
Bond	64	246
Clark	200	847
Clay	521	2,221
Clinton	294	1,083
Crawford	584	2,577
Cumberland	62	265
Edwards	162	706
Effingham	123	550
Fayette	397	1,727
Franklin	1,617	8,974
Gallatin	196	761
Hamilton	368	1,622
Jackson	374	2,222
Jasper	169	660
Jefferson	1,051	6,115
Lawrence	661	2,901
Marion	503	2,668
Perry	584	(D)
Randolph	416	2,703
Richland	597	2,578
Saline	768	4,207
Shelby	16	71
Wabash	480	2,028
Washington	130	463
Wayne	655	2,887
White	962	4,023
Williamson	1,630	9,718
Regional total	13,584	64,823
State total	27,482	144,359
Percentage of state total	49.4	44.9

*Source: U.S. Census of Mineral Industries, 1958.
(D) Withheld to avoid disclosing data for individual companies.

OIL AND GAS

The Southeastern Illinois Region composes the major portion of the deep part of the Illinois Basin. The region has been and is now the principal oil and gas producing area in the state. During the past decade it has contributed more than 95 percent of the state's production of these commodities. Production has come from rocks of various ages, but those of Mississippian age have contributed about three-quarters of the total. Locations of the various oil and gas fields in the region are shown in figure 3. Relatively little exploration has been done in the deeper rocks where possibilities for greater and

TABLE 2 - MINERAL PRODUCTION IN THE SOUTHEASTERN ILLINOIS REGION

Commodity	Quantity	Value	Operations	Average value ($/ton)
		1963		
Coal (tons)	24,839,022	$ 94,580,629	54	$3.80
Crude oil (barrels)	72,082,000	211,915,200	--	2.94/bbl
Crushed & broken stone (tons)	2,293,005	3,237,798	16	1.41
Sand	756,108	645,326	20	0.85
Gravel	842,235	737,214	24	0.88
Other materials*	----	5,647,848	--	---
Total value		$316,764,015		
		1964		
Coal (tons)	26,527,563	$100,539,465	56	$3.79
Crude oil (bbls)	67,194,000	196,878,420	--	2.93/bbl
Crushed & broken stone (tons)	2,451,687	3,768,890	16	1.54
Sand	1,091,000	878,000	25	0.80
Gravel	962,000	1,073,000	26	1.12
Other materials*	----	4,507,822	--	---
Total value		$307,645,597		

*Includes clay products and gas (natural and liquefied petroleum gas).

new production may exist. The general oil resources and future prospects for the finding of oil in Illinois were discussed by Bell (1955). Illinois State Geological Survey Circular 368 (Bell et al., 1964) contains a discussion of deep oil possibilities of the Illinois Basin.

Peak production in the state and in the Southeastern Illinois Region was achieved in 1940, and primary production has declined since then. Part of the decline has been offset by secondary recovery through waterflooding and hydraulic fracturing techniques. The number of active waterfloods in operation has risen from 354 in 1957 to 819 in 1964.

During the past decade, the years of highest production were 1955 and 1958 when 78.1 million and 77.5 million barrels, respectively, were produced in the Southeastern Illinois Region. Since 1958 production has declined somewhat, and production for 1964 was the lowest since 1954. Drilling activity has declined in the region since 1955 (fig. 4). Unless some new major pools are discovered, the trend of Illinois oil production will continue to be downward. Figure 5 is a graphic representation of the region's crude oil production from 1954 to 1964. Crude oil production for each county in 1964 is shown in figure 6, and figure 7 gives the counties' cumulative crude oil production from 1888 to 1964.

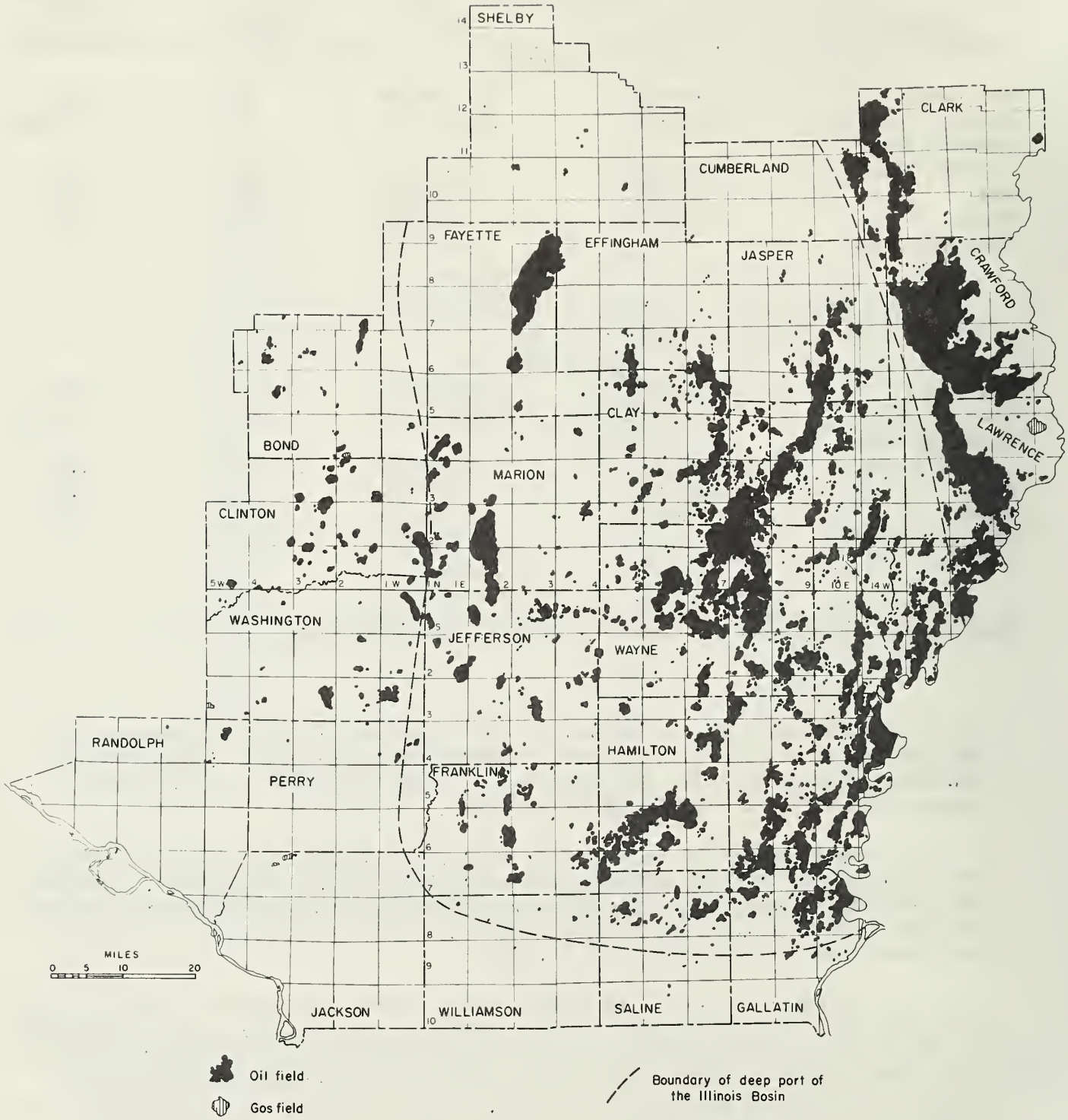


Fig. 3 - Oil and gas fields in the Southeastern Illinois Region.

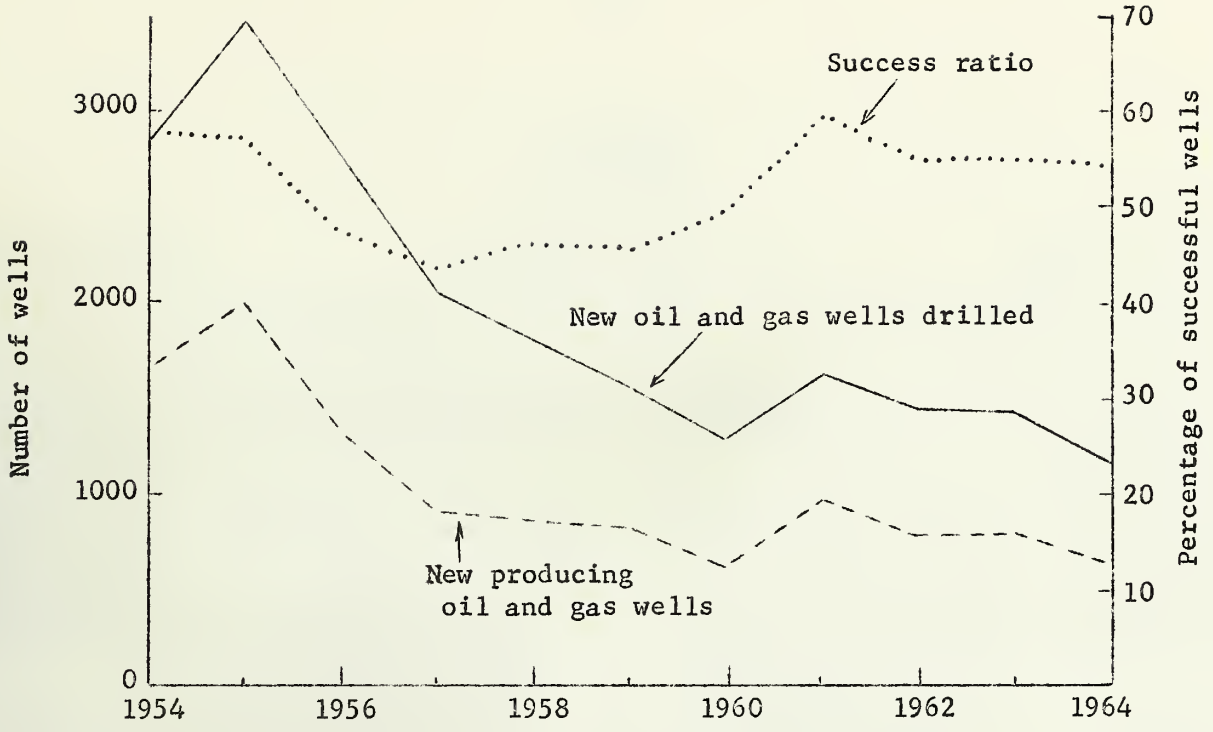


Fig. 4—Drilling activity in the Southeastern Illinois Region, 1954-1964.

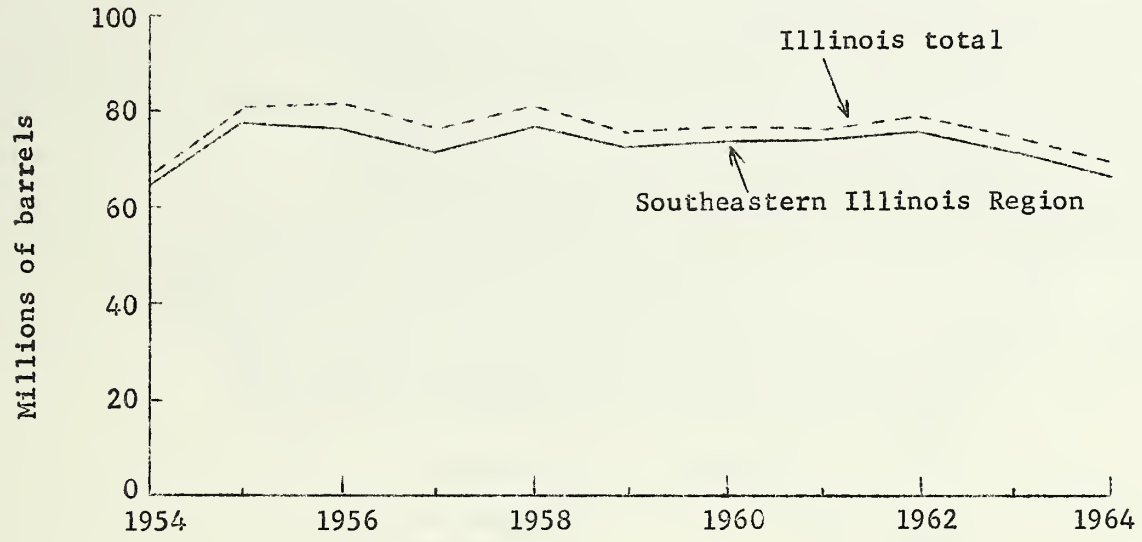


Fig. 5—Crude oil production in the Southeastern Illinois Region and in the state of Illinois, 1954 to 1964.

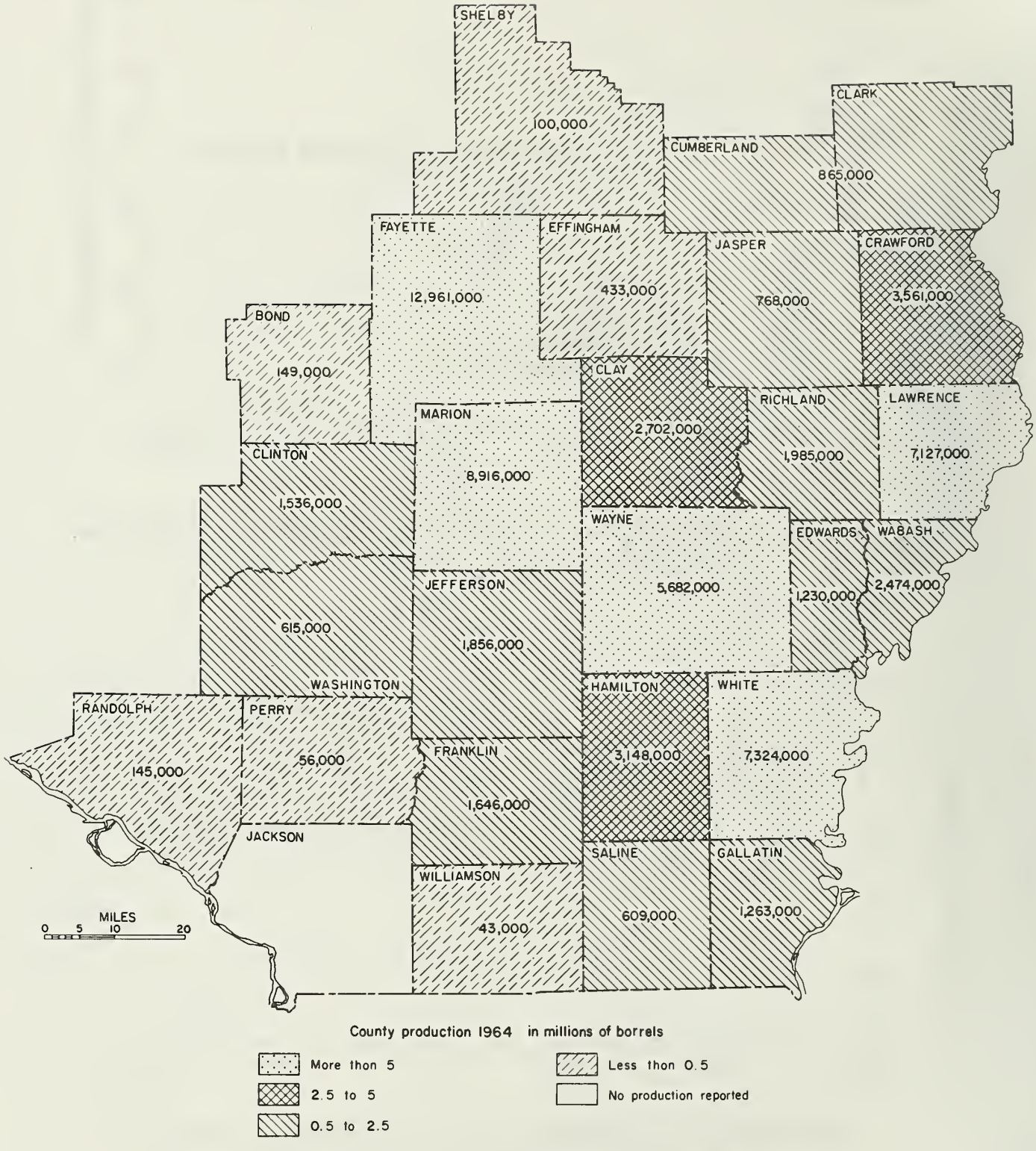


Fig. 6 - Crude oil production by counties in 1964 in the Southeastern Illinois Region.

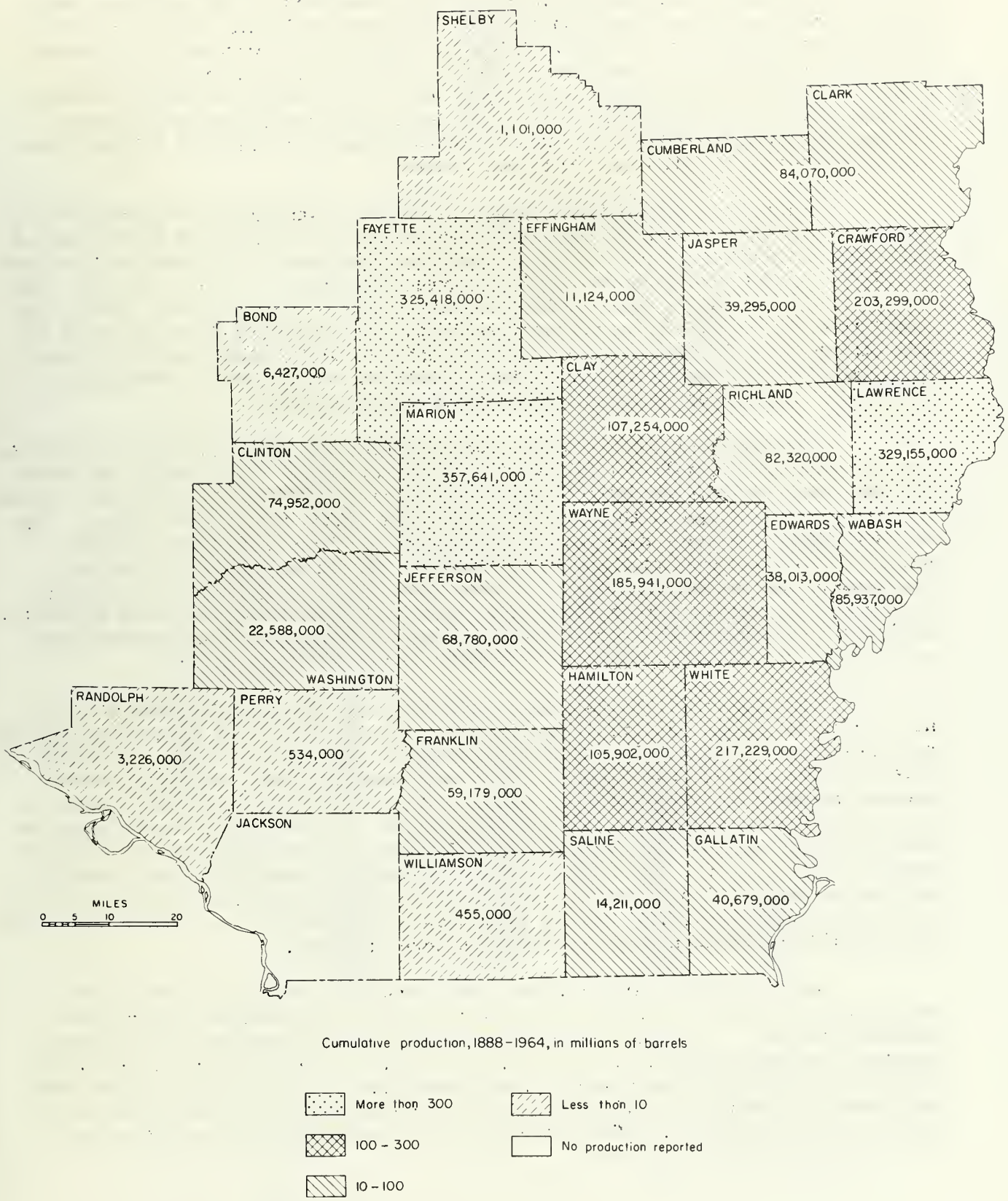


Fig. 7 - Cumulative crude oil production by counties, 1888-1964, for the Southeastern Illinois Region.

COAL

Illinois is abundantly endowed with bituminous coal resources. A detailed assessment and classification of coal reserves in the state was begun in 1950 and results were published by the Illinois Geological Survey in 1952 as Bulletin 78 (Cady et al., 1952). Estimates for 20 coals were made and grouped into four categories of reserves—proved, probable, strongly indicated, and weakly indicated—based on reliability of data. All coals that were less than 28 inches thick were excluded. The total estimated reserves of all classes amounted to more than 137 billion tons in the ground, of which 61 billion tons were included in the two most reliable classes.

In 1957 a new study was begun to evaluate strippable coal reserves in the state. The state was divided into nine resource regions, and by the end of 1965 studies of five of these regions had been completed. The results have been published as Illinois State Geological Survey Circulars 228, 260, 311, 348, and 374 (Smith, 1957, 1958, 1961; Smith and Berggren, 1963; Reinertsen, 1964). In these reports the coal reserves were estimated in categories based on depth of overburden (0 to 50 feet, 50 to 100 feet, and 100 to 150 feet), and according to reliability of data (Class I, primary reserves, and Class II, secondary reserves). Coals less than 18 inches thick were excluded.

Earlier estimates of total coal reserves for the Southeastern Illinois Region, reported in Bulletin 78, were modified by Smith (1957, 1958), who added the new reserves that had been calculated in the strippable coal reserves studies and subtracted the areas that had been mined out since the earlier report. The revised figure for coal reserves in the ground in the Southeastern Illinois Region is 74.9 billion tons, more than half of the state total. In the six counties within the region that have been surveyed the reserves of strippable coal are estimated at 3.4 billion tons. Figure 8 shows available data on strippable coal reserves and figure 9 shows the revised county-by-county breakdown on total minable coal reserves in the Southeastern Illinois Region.

For more than 50 years there has been considerable interest in Illinois coals of low-or relatively low-sulfur content. The first systematic studies of low-sulfur areas in Illinois probably were by Cady (1919, 1922). Hundreds of face channel samples from Illinois mines have been analyzed and their sulfur content reported in the past half century (Cady, 1935, 1948). A rough check of the records reveals that most of the analyses of Illinois coals show a range of from 3 to 5 percent sulfur (dry basis), although some show slightly to markedly higher sulfur content. Important areas of relatively low-sulfur coal occur in the Southeastern Illinois Region in which the sulfur content of the coal is from 1 to 2.5 percent (fig. 10). Areas indicated as "split coal area" were eliminated from consideration when reserve estimates were prepared.

One area containing coal of such low-sulfur content occurs in the Herrin (No. 6) Coal in parts of Jefferson, Franklin, Williamson, Perry, and Jackson Counties. A substantial part of this coal in Franklin and Williamson Counties has been mined out, but important reserves still remain in the northern part of Franklin County and in Jefferson County. After making adjustments for mined-out areas, the Illinois State Geological Survey personnel have estimated the low-sulfur No. 6 Coal reserves in the ground at 1029 million tons,

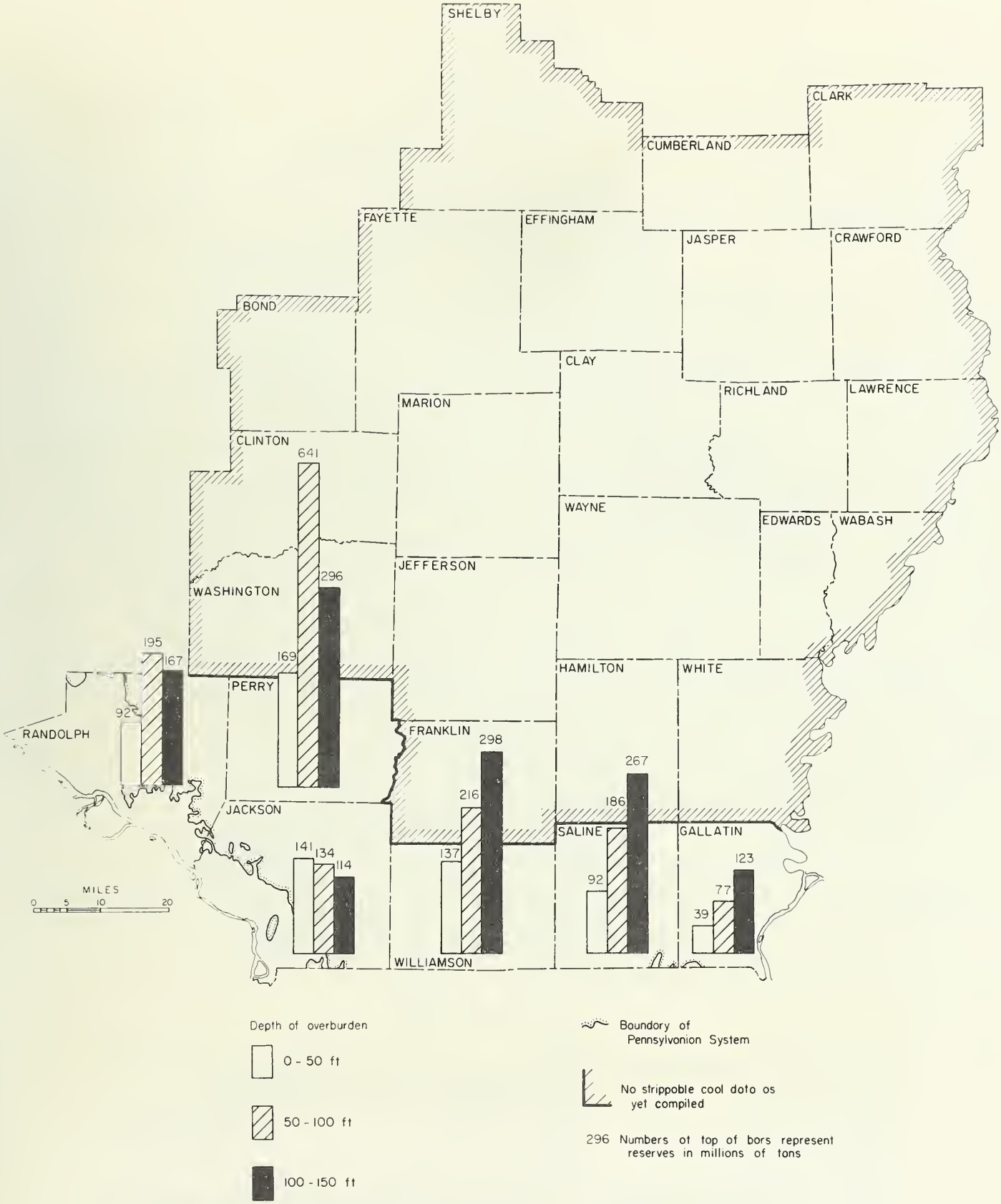


Fig. 8 - Strippable coal reserves in the Southeastern Illinois Region. (Data from Smith, 1958 and 1961.)

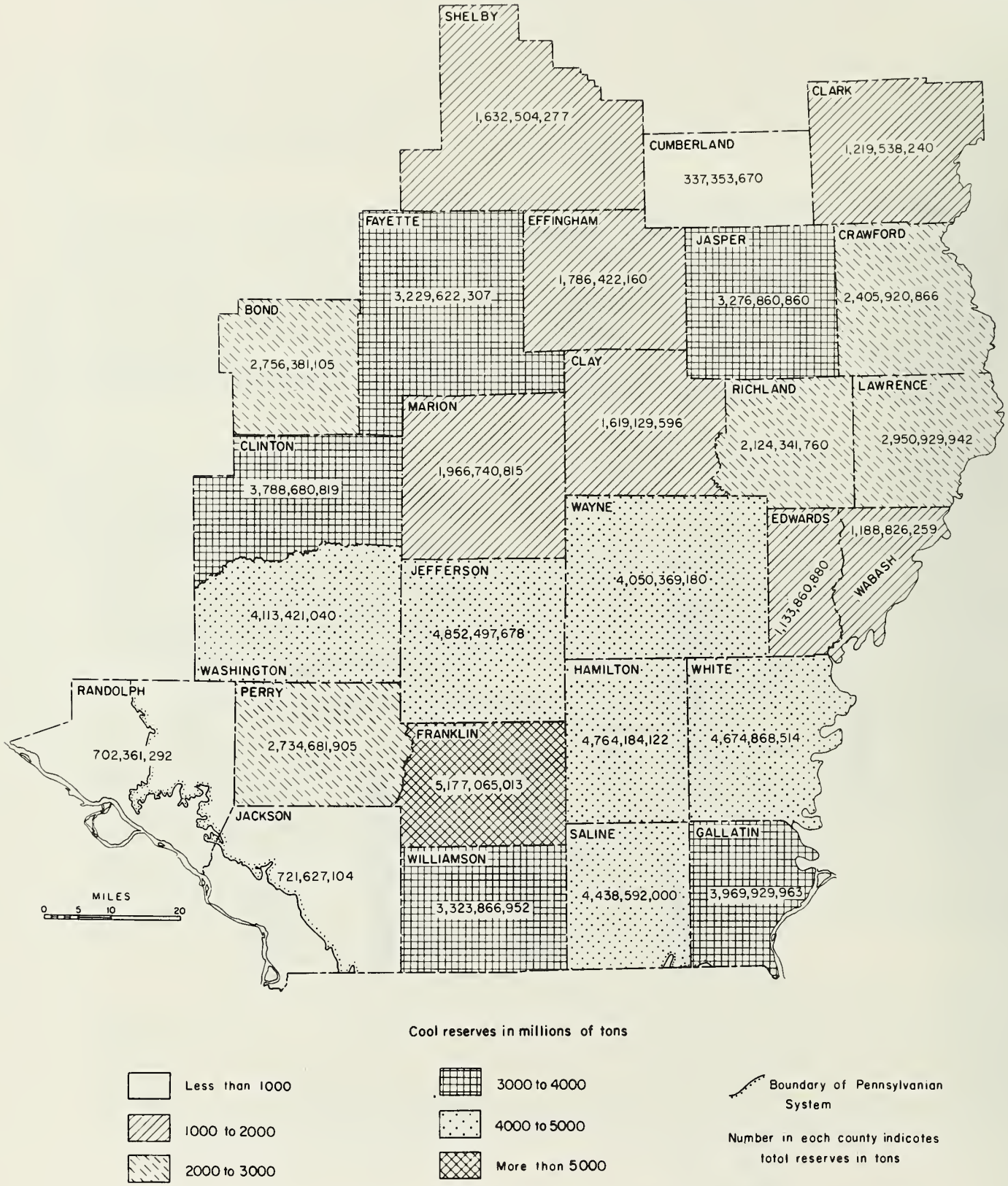


Fig. 9 - Total estimated coal reserves (in place) in the Southeastern Illinois Region.

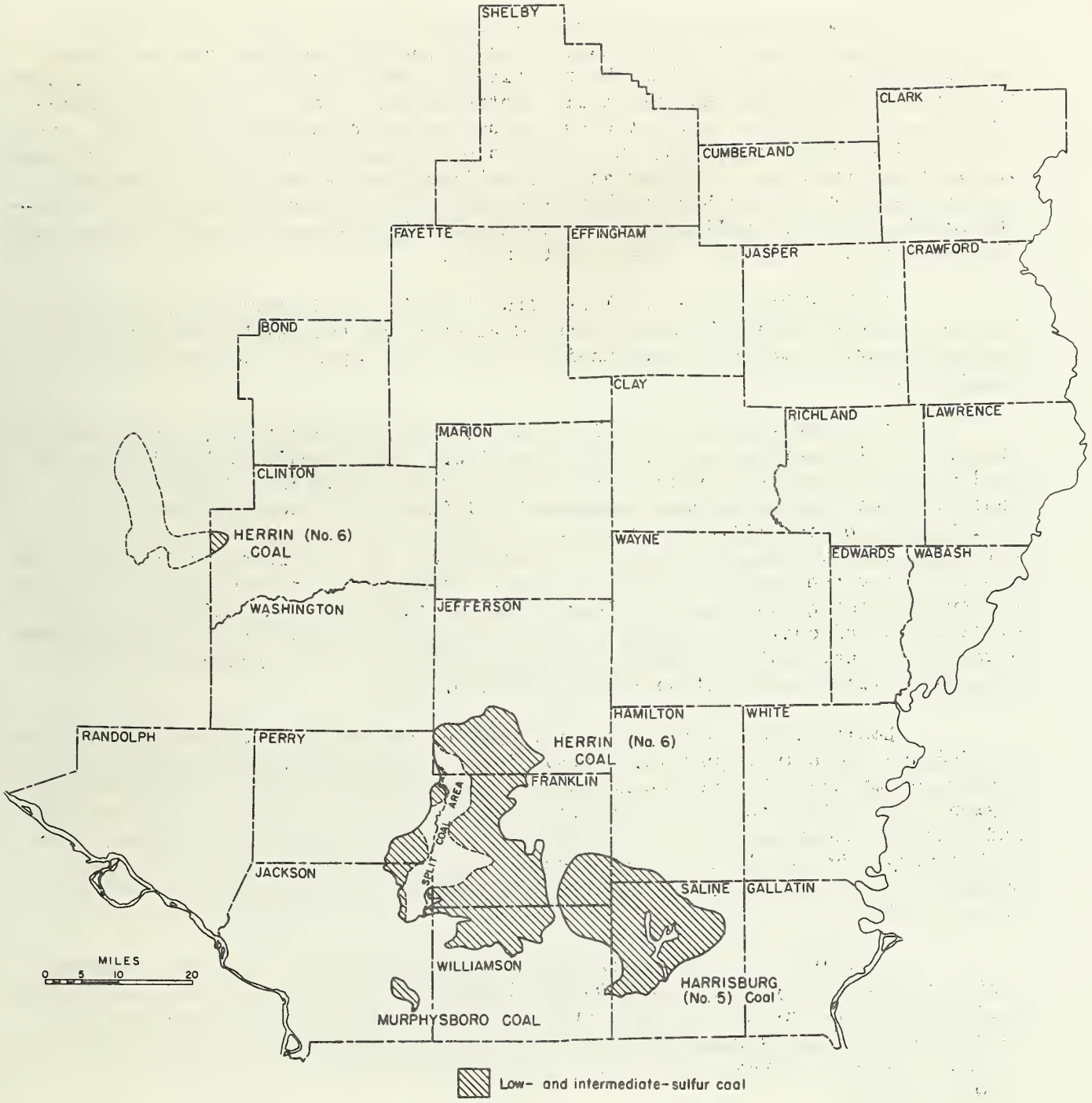


Fig. 10 - Areas containing low- and intermediate-sulfur coal in the Southeastern Illinois Region.

averaging 1.5 percent sulfur. This total is broken down by county as: Jefferson—585 million, Franklin—312 million, Williamson—59 million, Jackson—37 million, and Perry—35 million (Simon, 1966, p. 4).

In an area lying principally in Saline County, but also including parts of adjacent Hamilton, Williamson, and Franklin Counties, the Harrisburg (No. 5) Coal also falls within the relatively low-sulfur range, although it contains more sulfur than the previously mentioned No. 6 Coal. It should, therefore, more properly be designated as medium- or intermediate-sulfur coal. After allowing for mined-out areas, the reserves of medium-sulfur coal (No. 5) remaining in the ground are estimated at 1057 million tons, averaging 2.25 percent sulfur. This total has been broken down on a county basis as follows: Saline—585 million tons, Franklin--249 million tons, Williamson—130 million tons, and Hamilton--93 million tons (Simon, 1966, p. 5).

A third known area of low-sulfur coal in the Southeastern Illinois Region was reported in the Murphysboro Coal near the town of Murphysboro in Jackson County. Available data indicate that this deposit has been largely mined out.

A fourth area of low-sulfur coal occurs in the East St. Louis Region, principally in Madison and St. Clair Counties. This deposit of Herrin (No. 6) Coal was discussed previously in Mineral Economics Brief 12. However, since that time the low-sulfur coal reserves in Illinois have been reviewed by the Coal Section of the Illinois Geological Survey. As a result of raising the cut-off limit to 2.5 percent sulfur, the boundary of the coal reserves in this area has been extended and now includes a small acreage in Clinton County. The total reserves in the ground in this block of No. 6 Coal have been estimated at 649 million tons of coal, averaging 1.5 percent sulfur. This total has been broken down on a county basis as follows: St. Clair—381 million, Madison—245 million, and Clinton--23 million (Simon, 1966, p. 4-5).

Locations of coal mine operations in the Southeastern Illinois Region in 1964 are shown in figure 11. Local mines producing less than 10,000 tons in 1964 were omitted. Production has been reported in 22 of the counties of the region, but in 1964 only 10 of the counties were active (fig. 11). Williamson and Franklin Counties led 1964 production and past cumulative production. For each county, the cumulative production of coal from 1882 to 1964, the total number of active mining years, and the last year of reported production are given in figure 12.

Figures 13 and 14 indicate some general trends in the coal industry during the past 17 years. From 1948 to 1964, the number of operating coal mines declined sharply but the over-all production increased slightly because the average size of mines was growing and, with mechanization, the productivity of workmen also was increasing. Strip mining has shown a steady, but modest, growth record.

Table 3 gives the average reported value per ton of coal produced, by county and year, from 1955 to 1964.

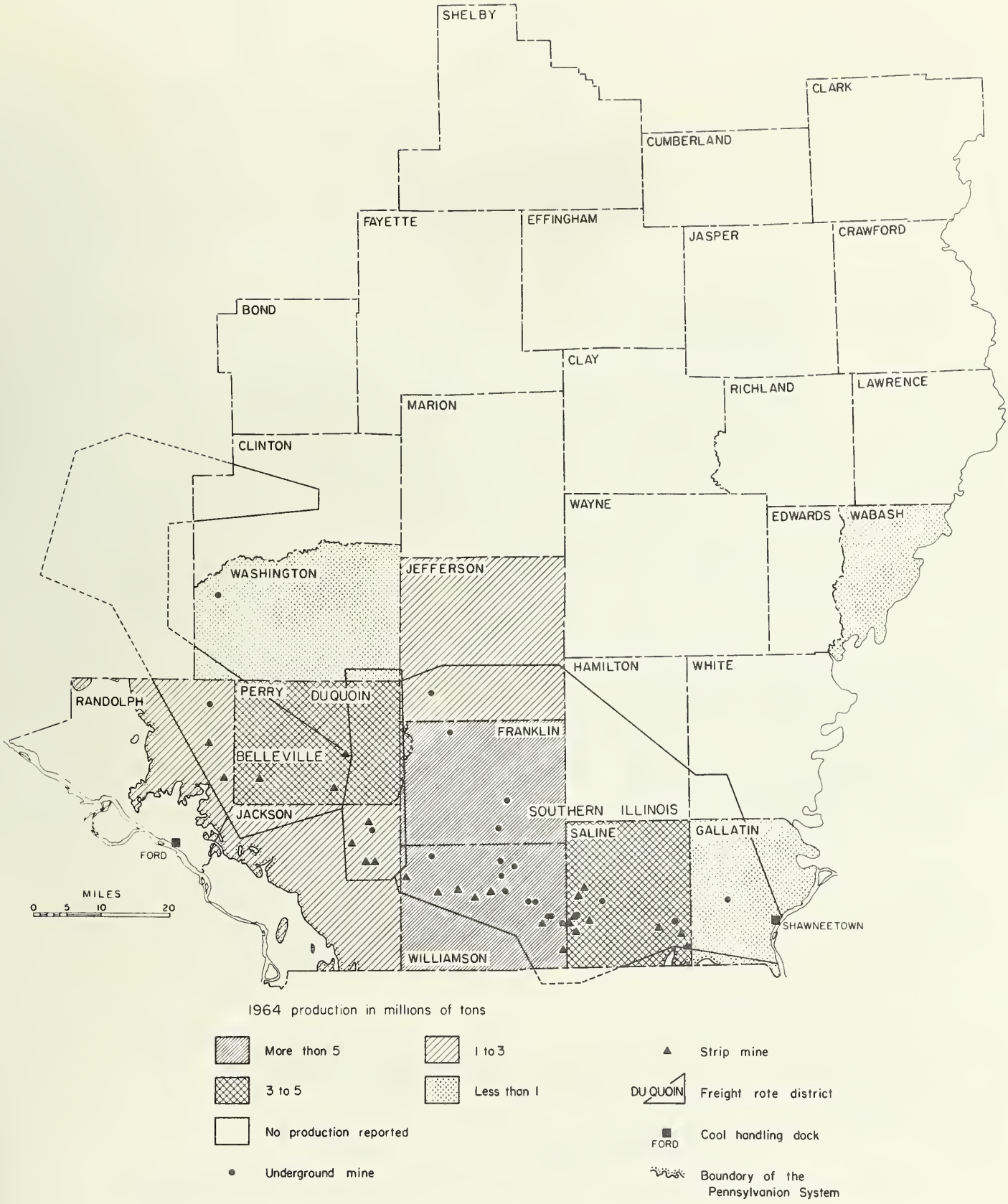


Fig. 11 - Coal mines and production in the Southeastern Illinois Region, 1964.

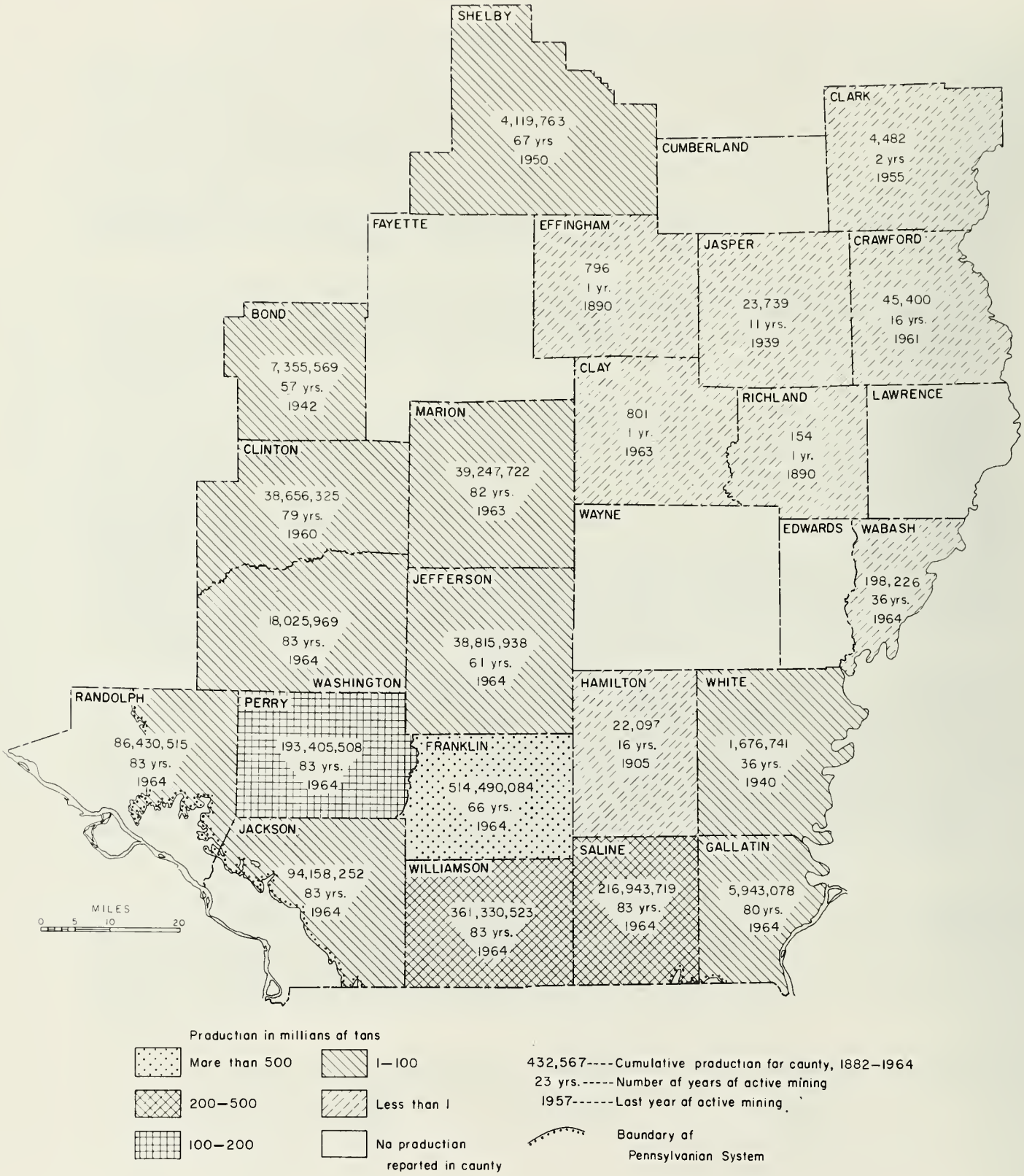


Fig. 12 - Cumulative coal production data, 1882-1964, for the Southeastern Illinois Region.

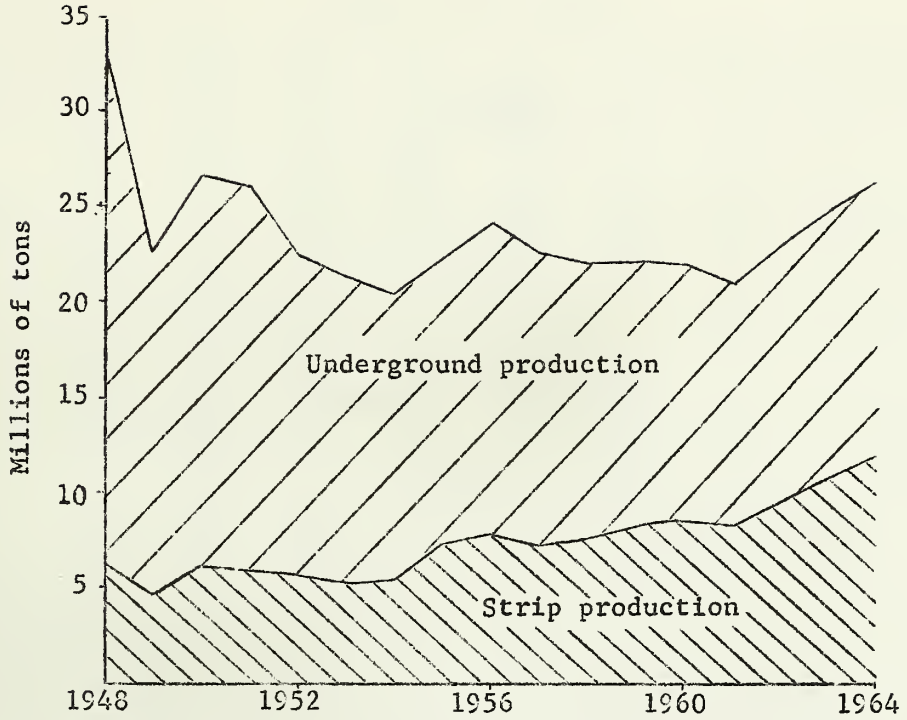


Fig. 13—Annual coal production in the Southeastern Illinois Region, 1948 to 1964.

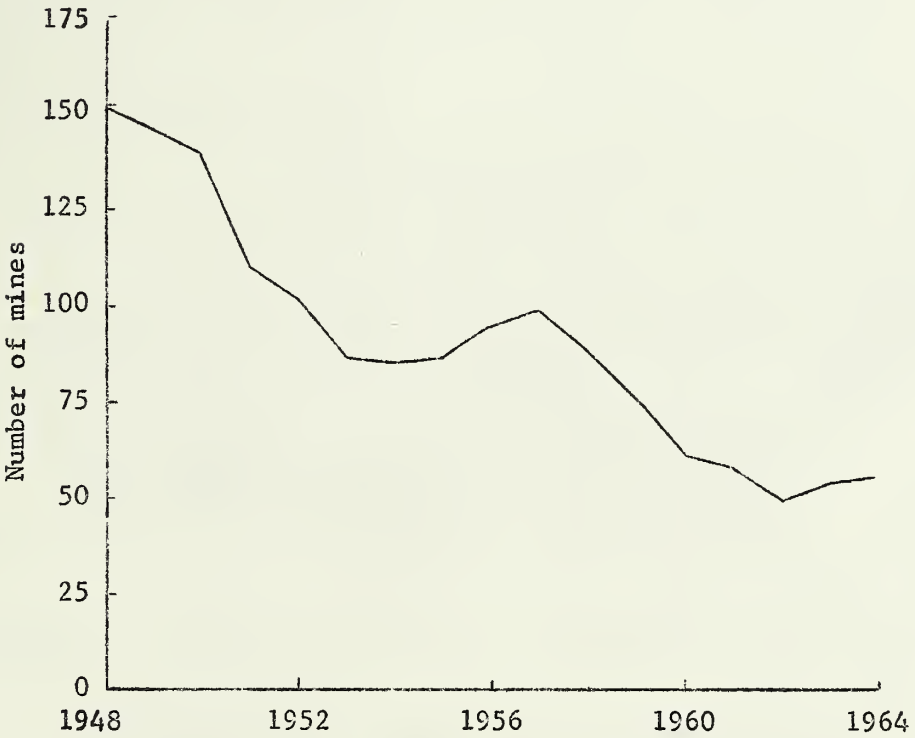


Fig. 14—Number of operating coal mines in the Southeastern Illinois Region, 1948 to 1964.

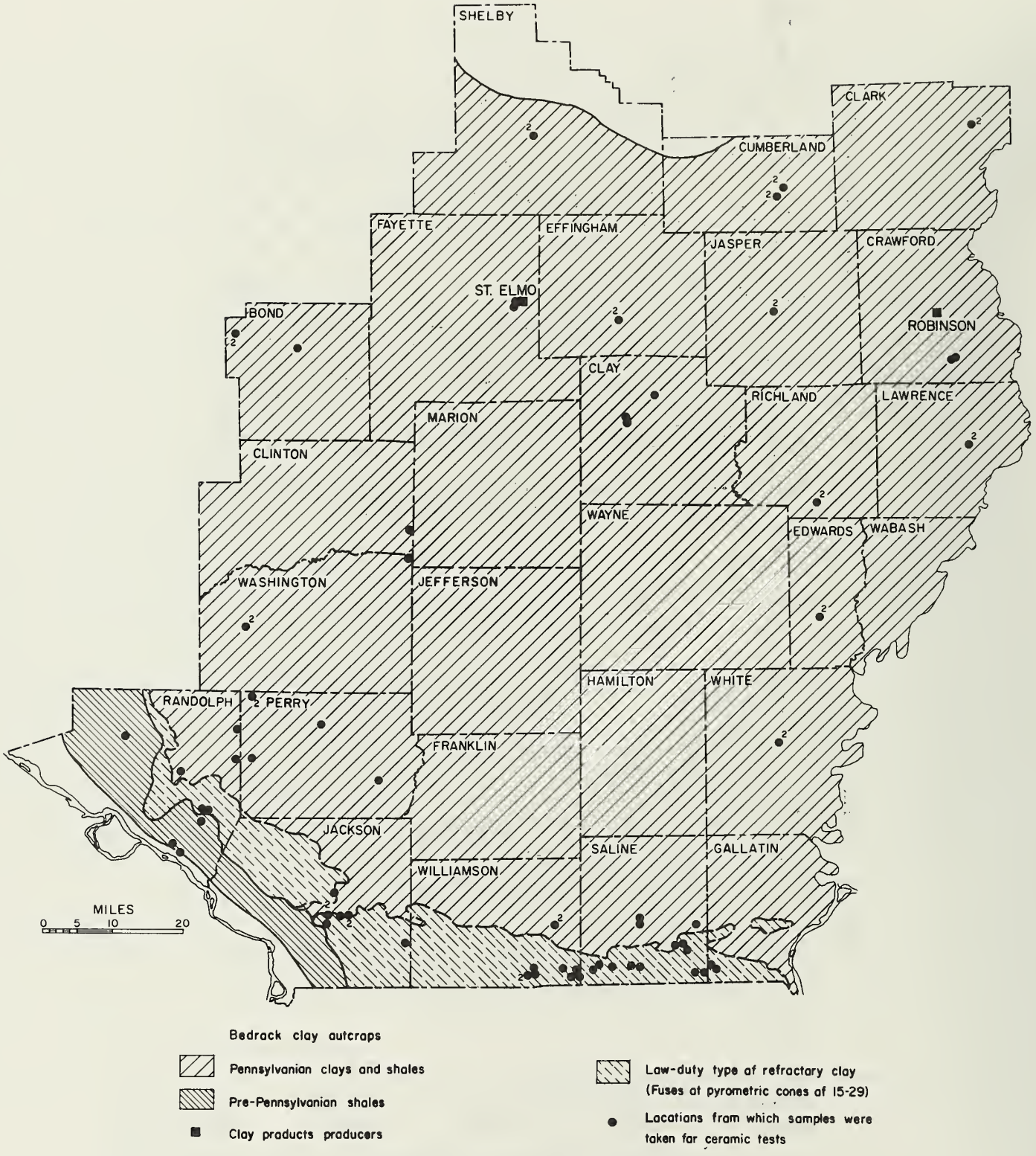


Fig. 15 - Clay resources, sample locations, and operations in the Southeastern Illinois Region.

TABLE 3 - COAL VALUES*

County	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
Clinton	3.78	3.92	4.58	5.21	4.45	4.30	5.27	--	--	--
Franklin	4.24	4.26	4.35	4.25	W	W	W	W	W	W
Gallatin	2.74	2.98	3.17	2.79	W	3.41	3.14	3.36	W	3.25
Jackson	3.42	3.61	W	W	4.13	3.84	W	W	W	W
Jefferson	4.06	4.08	4.42	W	W	W	W	W	W	W
Marion	--	3.72	4.07	4.35	4.61	--	3.80	3.75	3.70	--
Perry	3.10	3.62	W	3.49	3.46	3.63	W	W	3.43	W
Randolph	3.00	3.67	3.40	3.30	3.46	W	W	W	W	W
Saline	3.81	3.75	W	W	4.17	4.05	3.92	3.80	3.75	3.73
Wabash	--	--	--	--	5.00	5.00	4.13	4.13	4.13	4.10
Washington	5.00	4.73	4.10	W	4.97	4.66	W	W	W	W
Williamson	3.70	3.86	3.96	3.97	4.08	3.99	3.94	3.80	3.79	3.83
State average	3.66	3.84	4.00	4.02	4.06	4.00	3.91	3.86	3.80	3.79

* Source: U. S. Bureau of Mines Minerals Yearbooks. Average value per ton = value received or charged for coal f.o.b. mines as reported to the U. S. Bureau of Mines. Includes a value for coal not sold but used by producers, such as mines fuel and coal coked, as estimated at average prices that might have been received if such coal had been sold commercially.

W = Withheld to avoid disclosing individual company data.

CLAY AND CLAY PRODUCTS

Pennsylvanian clays and shales underlie most of the Southeastern Illinois Region. Although the present clay products industry is quite small, there are indications that resources for expansion of the industry do exist in the area. A number of clay and shale samples from the area have been collected and tested and results were published in White (1960), White and Lamar (1960), Parham and White (1963), and White and O'Brien (1964). Figure 15 shows the localities from which these samples were collected.

Figure 15 also indicates the approximate limits of the various types of "strippable" refractory clay and shale deposits. The term "strippable" is used rather loosely to indicate areas in which the ratio of overburden to clay thickness falls within the generally accepted limits of present mining practices and economics. Additional information on locations, tonnages, and types of clay resources can be obtained from Illinois State Geological Survey personnel.

White and Lamar (1960) compiled results of tests for 125 samples of clay that had been run at the Illinois Geological Survey over a period of years.

Of these samples, 30 were taken from localities in the Southeastern Illinois Region. The tests showed that one or more of the clays sampled could be used in the manufacture of drain tile, structural clay products, flower pots, sewer pipe, face brick, common brick, tile, pottery, fireproofing, and building blocks.

Parham and White (1963) listed the results of tests on 66 samples of clay collected in southern and southwestern Illinois, 21 of them from localities in the Southeastern Illinois Region. On the basis of these tests, one or more of the clays sampled were found suitable for making drain tile, flower pots, pottery, structural clay products, sewer pipe, stoneware, refractories, terra cotta, lightweight aggregates, flue liners, terra sigillata, and bonding clay.

New construction methods requiring lighter building materials have increased the market demand for lightweight aggregates. Illinois clay and shale resources suitable for such purposes were discussed by White (1960) and White and O'Brien (1964). Thirty-two of the samples tested were collected from localities in the Southeastern Illinois Region.

Many parts of Illinois contain clays and shales that may be of suitable chemical composition for cement making. The importance of these resources depends to a great extent upon their nearness to a market. A discussion of the clay and shale resources in the Southeastern Illinois Region that might be suitable for cement manufacture can be found in the report by Lamar et al. (1956).

Illinois is one of the leading producers of clay products, having turned out between 50 and 60 million dollars worth annually for the past decade. However, the Southeastern Illinois Region has produced only 6 to 11 percent of the state total from 1954 to 1964. Since 1957, the number of operators has declined from 5 to 2. Value of production reached a peak of $6.2 million in 1959 but had declined to $3.4 million by 1962 (the last year for which data are available for publication). As of 1964 there were two operations in the Southeastern Illinois Region—one in Fayette County and one in Crawford County (fig. 15). A third operation located in another part of the state is supplied with raw clay from a pit in Bond County. As can be seen in figure 16, the value of clay products manufactured in the region has varied considerably during the past 10 years.

LIMESTONE

In Illinois the principal products of the stone industry are crushed and broken stone for road surfacing, for agricultural limestone, and for aggregate used in concrete and bituminous roads and in concrete structures. The Southeastern Illinois Region contains widespread carbonate rock resources (fig. 17). The bulk of the limestone occurs in rock formations of Pennsylvanian age. These beds generally are less than 25 feet thick but often are much thinner. The purity of the limestone varies from place to place and careful planning and proving-out of reserves are required before quarry operations can be justified. Of lesser areal extent are the limestones of Mississippian age that occur in the territory adjacent to the Mississippi River. These deposits are thick to moderately thick, locally cherty, and are interbedded with shales at some localities.

Fig. 16—Value of clay products production in the Southeastern Illinois Region, 1954-1962. More recent data are confidential.

Detailed information concerning the agricultural limestones of Cumberland, Effingham, Clay, Richland, and Jasper Counties can be found in the report by Grogan and Lamar (1940). The limestones of the Lower Kaskaskia Valley and the limestones of Jefferson and Marion Counties have been discussed in recent Survey publications by Bradbury (1963, 1965). A discussion of the limestone resources in the Southeastern Illinois Region that might be suitable for cement manufacture can be found in the report by Lamar et al. (1956, p. 18-20, 24-25, 28-33).

Regional production and value of crushed and broken stone produced from 1954 to 1964 are shown in figure 18. In 1964, 16 quarries in 10 counties reported a combined production of 2.5 million tons, or about 6.4 percent of the state's total stone production for that year. Randolph, Clark, and Jackson Counties produced the highest tonnages.

SAND AND GRAVEL

Sand and gravel deposits are important natural resources that occur in many places in Illinois. These deposits are, with the exception of a few located in extreme southern and western Illinois, related directly or indirectly to past

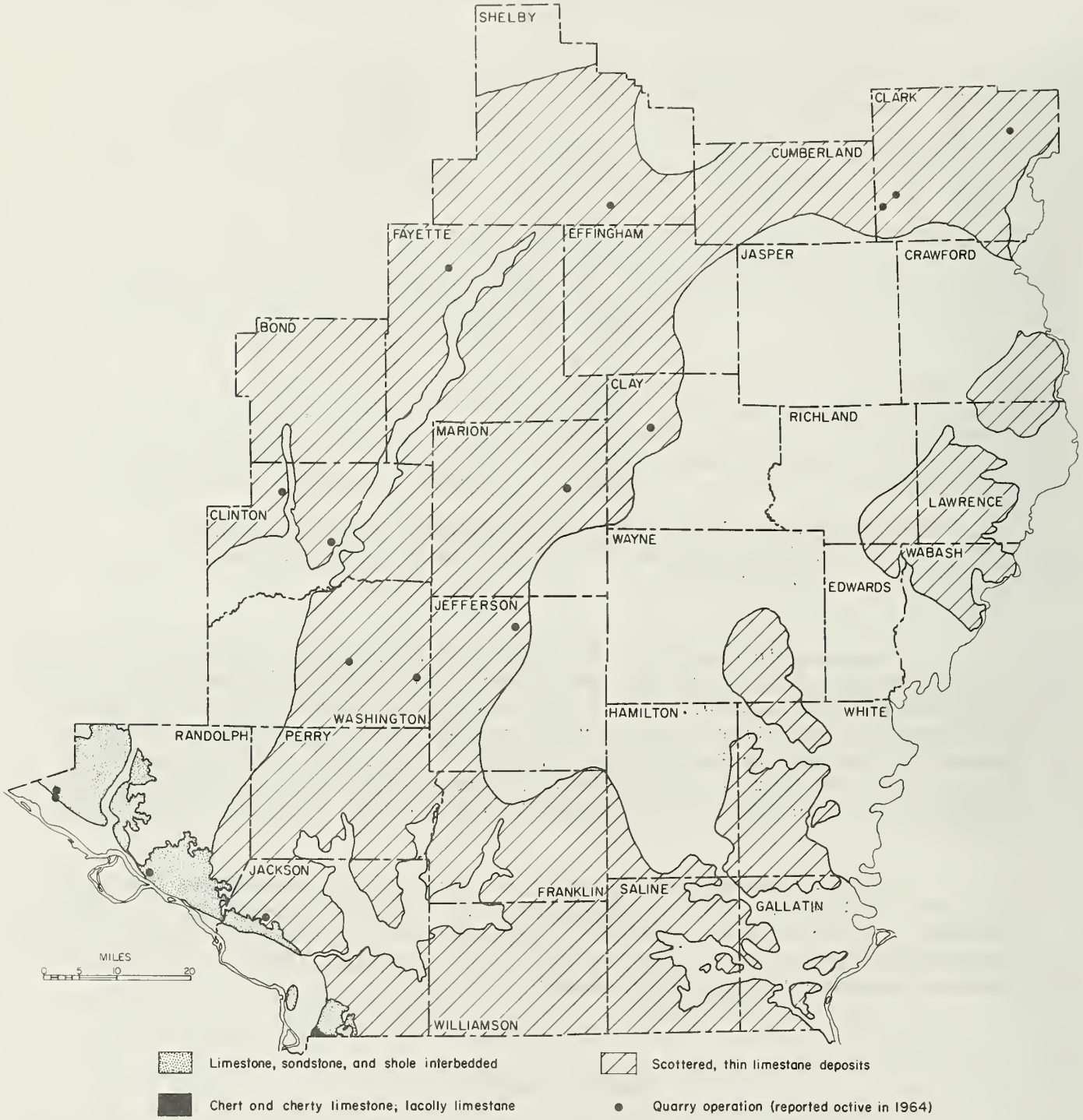


Fig. 17 - Outcrop and near-surface deposits of limestone and dolomite and location of operations in the Southeastern Illinois Region. (Adapted from "Preliminary Map of Limestone Outcrops," compiled by Lamar and Shrode, 1950.)

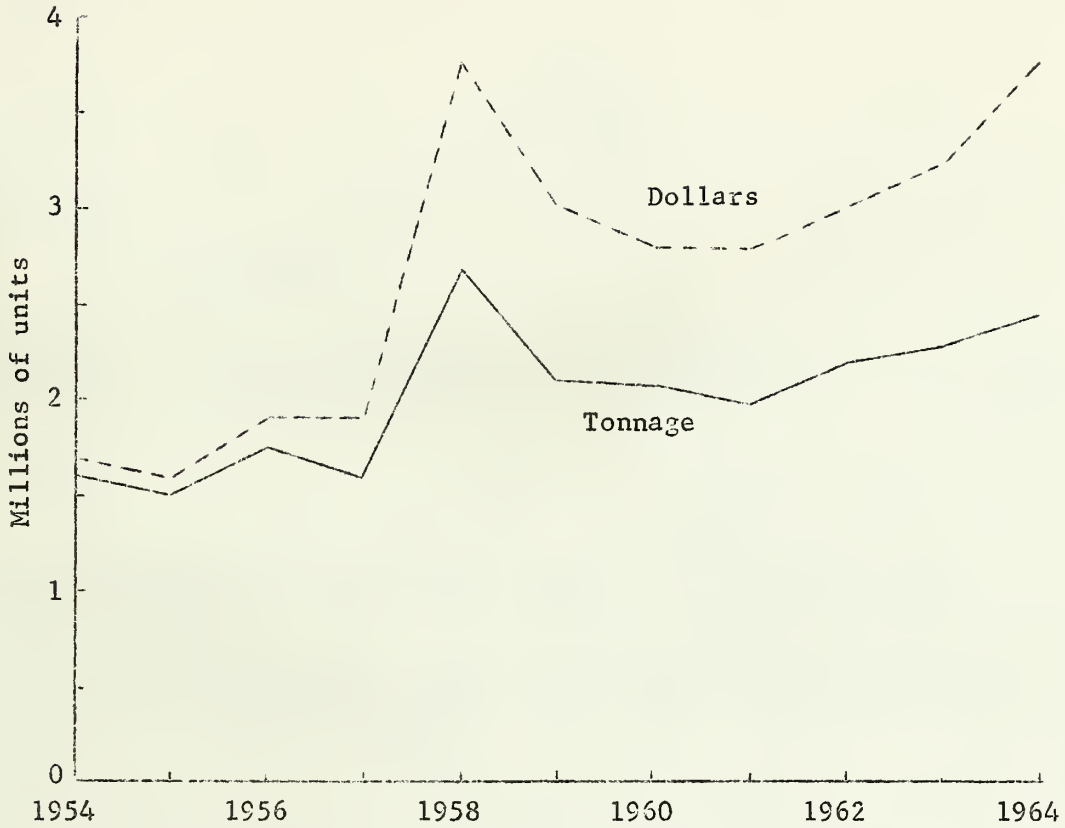


Fig. 18—Production and value of crushed and broken stone in the Southeastern Illinois Region, 1954 to 1964.

glacial activity. The Illinoian and Wisconsinan glaciations produced the most important economic sand and gravel deposits in the state. An explanation of the origin of these deposits was prepared by Lamar and Willman (1958). Figure 19 shows the location of known sand and gravel resources in the Southeastern Illinois Region.

Meaningful data on reserves cannot be given. As sand and gravel are low-value commodities, the market area in which they may compete is usually sharply restricted. Transportation costs often represent a greater portion of the delivered price than the initial value of the raw material at the pit site. Because of this, a deposit usually must be quite close to the market area to be economic. A study of nationwide transportation patterns has shown that rail hauls for mineral aggregates average 80 to 90 miles; water hauls average 30 to 35 miles; truck hauls, accounting for about 80 percent of sand and gravel transportation, probably average well under 30 miles (Davidson, 1965, p. 1). However, these figures present an average of widely varying local conditions.

Regional production and value of sand produced between 1955 and 1964 are shown in figure 20. In 1964, 25 pits located in 12 counties reported sand production. Their combined production was 1.1 million tons, or about 8 percent

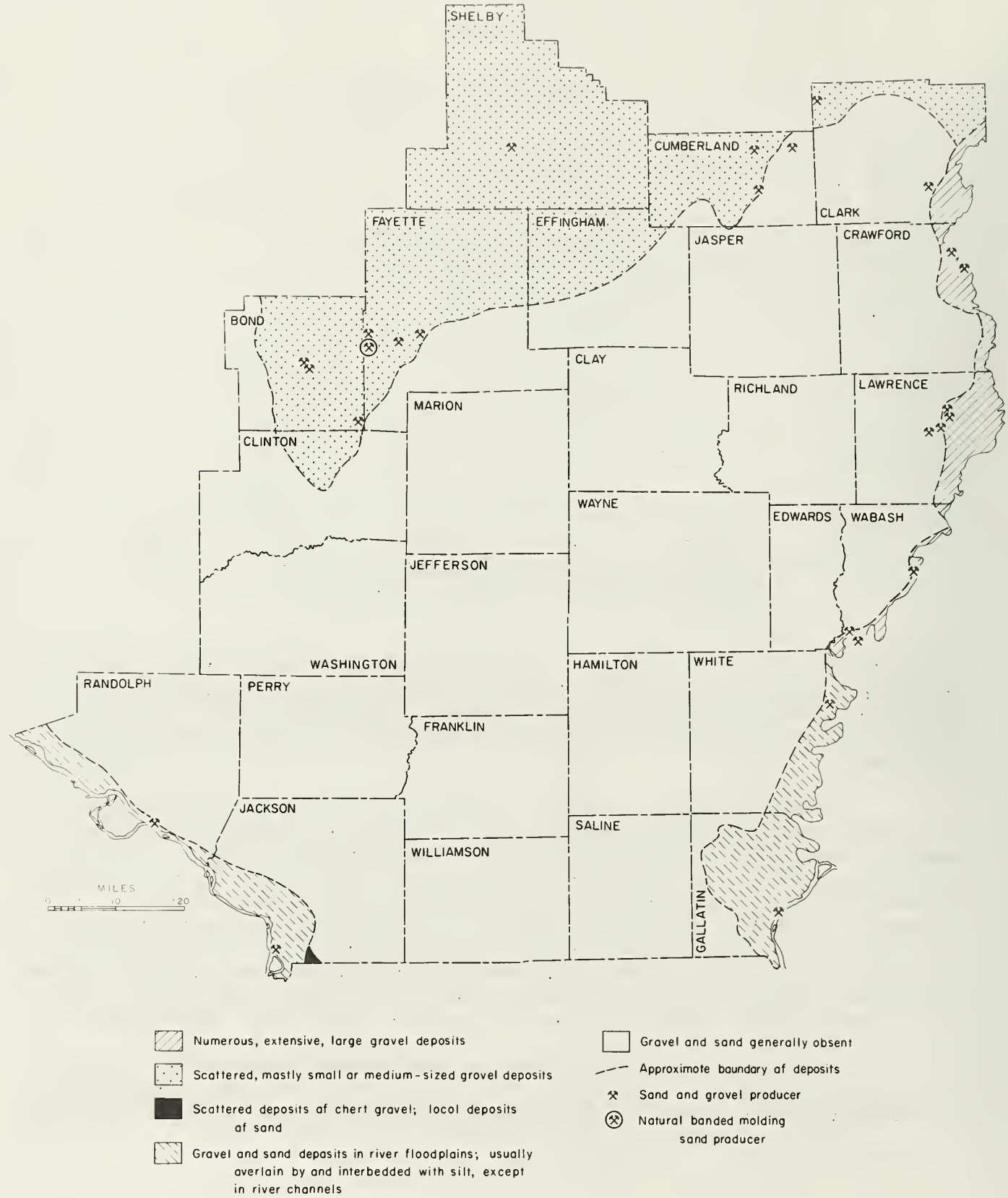


Fig. 19 - Sand and gravel resources and operations in the Southeastern Illinois Region. (From map on open file, "Sand and Gravel Resources of Illinois," by G. E. Ekblaw.)

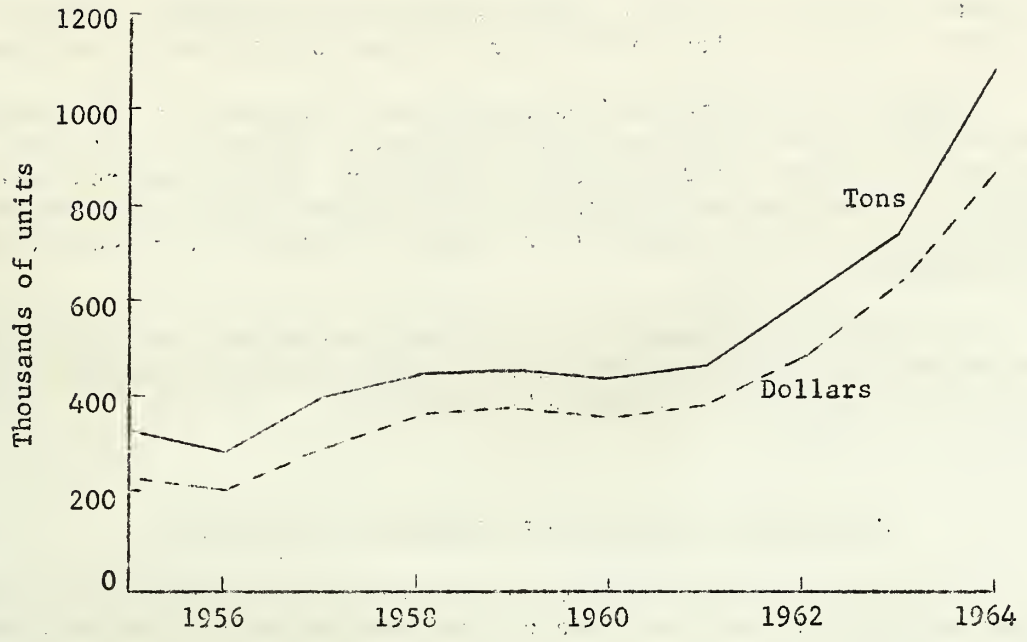


Fig. 20 - Production and value of sand in the Southeastern Illinois Region, 1955-1964.

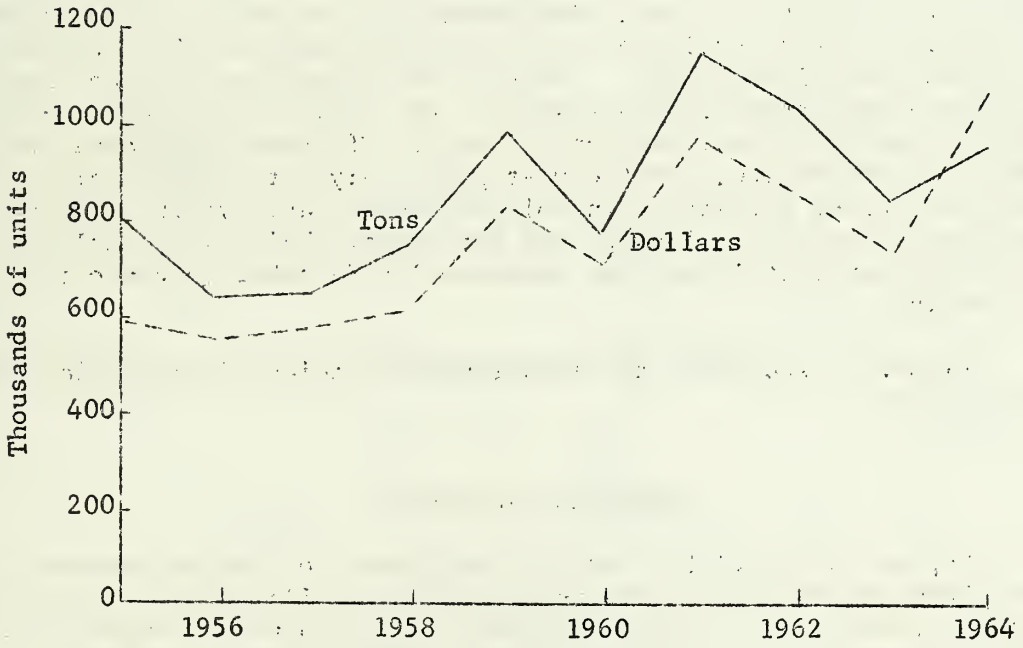


Fig. 21 - Production and value of gravel in the Southeastern Illinois Region, 1955-1964.

of the state total for that year. The leading sand-producing counties in the Southeastern Illinois Region in 1964 were Cumberland, Gallatin, and Randolph.

Regional production and value of gravel produced in the Southeastern Illinois Region between 1955 and 1964 are shown in figure 21. In 1964, 26 pits located in 10 counties reported gravel production. Their combined production amounted to 962,000 tons or 5.8 percent of the state total. The leading gravel-producing counties in the Southeastern Illinois Region in 1964 were Lawrence, Bond, and Wabash.

In addition to common sand and gravel producers, the region had one producer of natural bonded molding sand, located at Mulberry Grove in Fayette County, but the company ceased production in 1962.

UNDEVELOPED MINERALS OF POTENTIAL IMPORTANCE

Illinois possesses a number of mineral deposits that, at present, are not being used because the low grade of the material and/or the high processing costs have made their exploitation uneconomic. A brief discussion of these resources and the problems associated with their use is given below.

Oil Shale

Publications dated as early as 1870 reported the presence of oil in certain shales in Illinois, but no comprehensive testing of these shales was carried out until 1956. At that time members of the staff of the Illinois State Geological Survey collected and tested 114 samples taken from 41 counties (Lamar, Armon, and Simon, 1956). Fifty of the samples were taken from locations in the Southeastern Illinois Region, but only one of these (D-19) yielded more than 20 gallons of oil per ton of shale. Of equal importance is the fact that these oil shales are, for the most part, only 1 to 3 feet thick. As there are vast reserves of oil shales in Colorado, Utah, and Wyoming that yield an average of more than 30 gallons of oil per ton of shale, it is unlikely with present technology that it will be economically feasible to exploit these Illinois oil shales.

Figure 22 indicates the locations and yields of oil shale samples that were tested.

Gypsum and Anhydrite

Gypsum and anhydrite beds are not known to crop out anywhere in Illinois, but both minerals have been encountered in wells drilled in the St. Louis Formation of southern and central Illinois. The gypsum and anhydrite are interbedded with limestone and with each other. Unfortunately, in the Southeastern Illinois Region anhydrite, for which there is only a limited market, predominates in these deposits. The thickest deposits of gypsum in the area average about

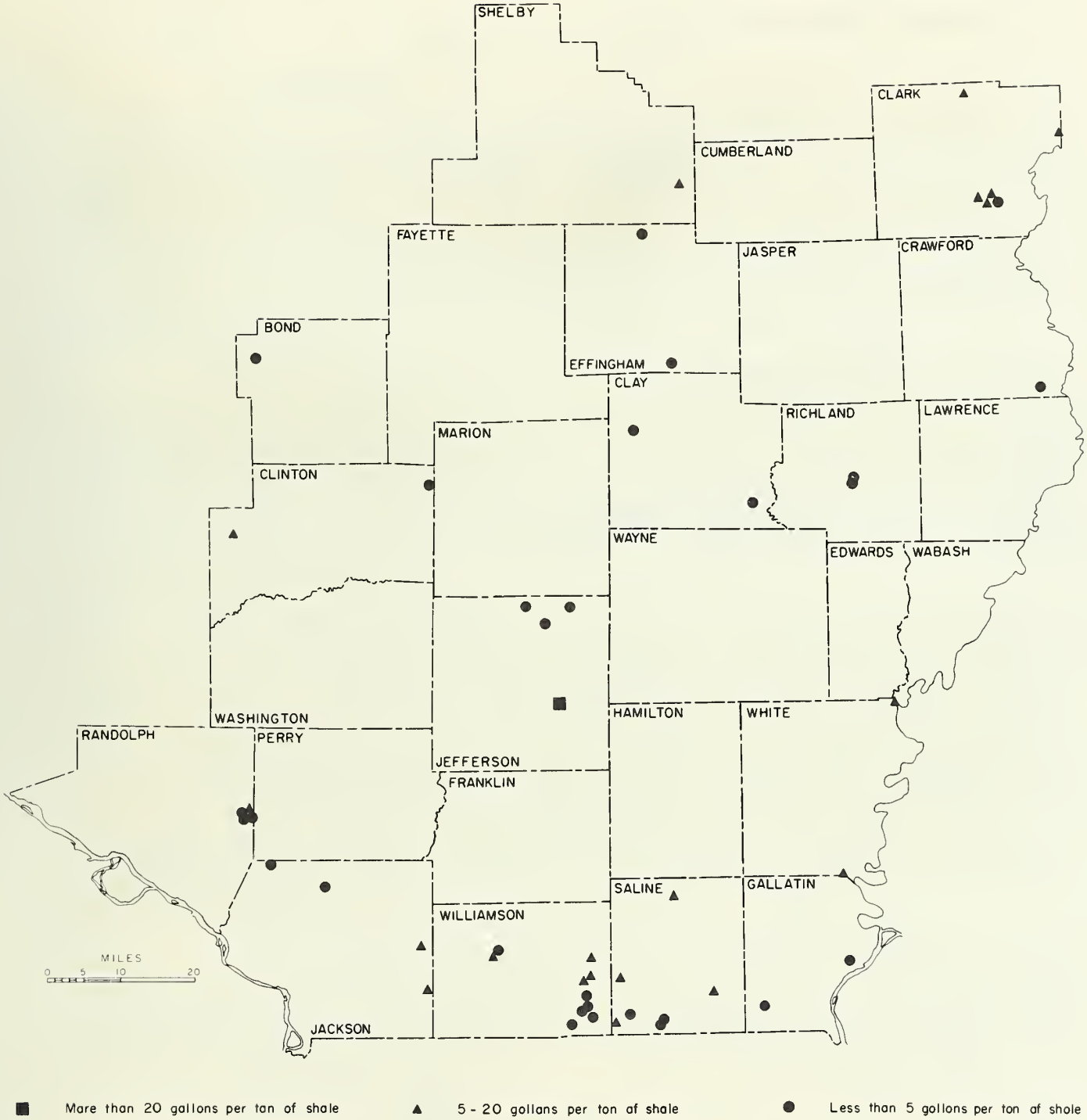
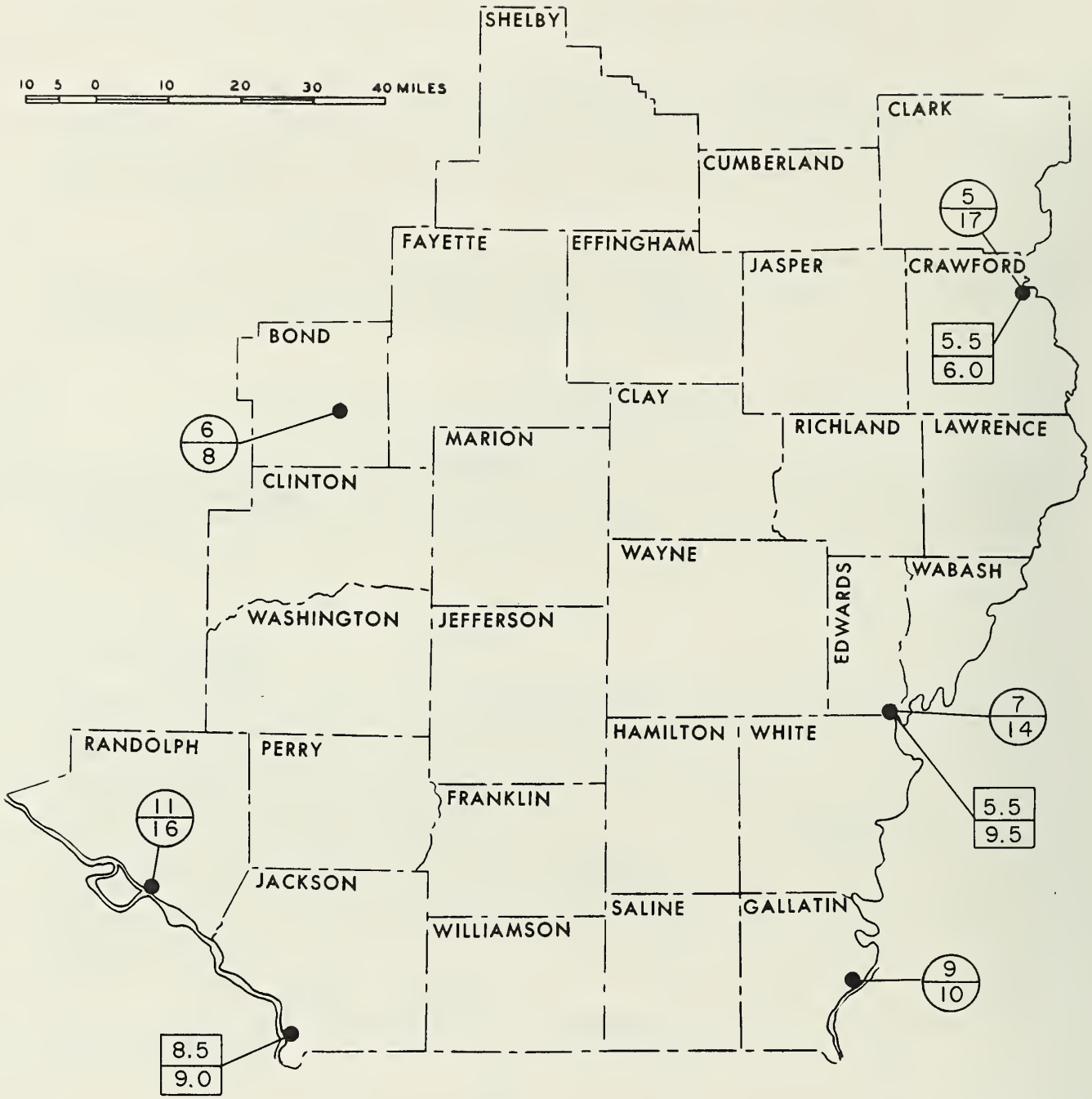


Fig. 22 - Localities from which oil shale samples were taken in the Southeastern Illinois Region.



Percentage of potash feldspar (acid treated) in the −8 +270 mesh fraction*

11/16

Percentage of soda−lime feldspar (acid treated) in the −8 +270 mesh fraction*

Percentage of potash feldspar (acid treated) in the −35 +200 mesh fraction of the sand sample+

5.5/6.0

Percentage of soda−lime feldspar (acid treated) in the −35 +200 mesh fraction of the sand sample+

Fig. 23 - Feldspar-bearing sands in the Southeastern Illinois Region. (*Willman, 1942; +Hunter, 1965.)

10 feet and occur in northwestern Bond County at a depth of 1000 to 1200 feet. Additional information concerning these resources was reported by Saxby and Lamar (1957).

Feldspar-Bearing Sands

Feldspar, an essential constituent in the manufacture of glass, pottery, and ceramics, is a mineral occurring in many Illinois sand deposits. In 1964 Illinois was the third largest domestic consumer of feldspar, using 73,967 tons, all of which had to be imported from other states as there is no Illinois feldspar production (U. S. Bur. Mines, 1965a, p. 470). At present, this imported feldspar comes from Colorado, South Dakota, and North Carolina and, therefore, substantial freight costs are involved. For this and other reasons, it has been suggested that certain of the sands in Illinois might be beneficiated to produce a feldspar concentrate of acceptable grade that could supply all or part of the state's needs.

Figure 23 gives the locations of the sand samples tested by Willman (1942) and Hunter (1965) for feldspar content. Five samples of feldspar-bearing sands—three from the Wabash River, one from the Mississippi River, and one from Bond County—were collected by Willman. Hunter restudied two of Willman's samples and tested an additional sample from the Mississippi River near Grand Tower in Jackson County. The Mississippi River sample taken near Chester in Randolph County yielded the highest potash feldspar and total feldspar content, while the highest soda-lime feldspar was found in the new sample taken by Hunter at Hutsonville in Crawford County.

The iron oxide content is a critical factor in the use of feldspar for ceramic and glass purposes. The maximum amount of iron oxide (Fe_2O_3) allowed in the feldspar for use in flint glass (clear glass) is 0.05 percent; in amber glass it is 0.50 percent (U. S. Bur. Mines, 1965b, p. 322). Hunter (1965), after studying the mode and occurrence and amount of iron oxide in the feldspars of his sand samples, found that the sands contain potash feldspar, soda-lime feldspar, and feldspathic rock fragments, and that the potash feldspar contains less iron oxide than either of the other forms. When the feldspars were treated with acid in the laboratory, their iron oxide content was reduced to levels acceptable for amber glass. Treated samples of potash feldspar contained from 0.10 to 0.31 percent iron oxide, whereas treated soda-lime feldspar had from 0.16 to 0.56 percent.

At the present time further work on beneficiation of feldspar-bearing sands in Illinois is being carried out by personnel in the Chemical Engineering Section of the Illinois Geological Survey. It is hoped that an economic process can be developed that will produce a feldspar concentrate of a grade acceptable for use in flint glass manufacture.

Pyrite (Coal Brasses)

All coals contain sulfur in varying amounts, and it occurs in three forms—as pyrite, in organic combination, and as sulfates. Much of the pyrite,

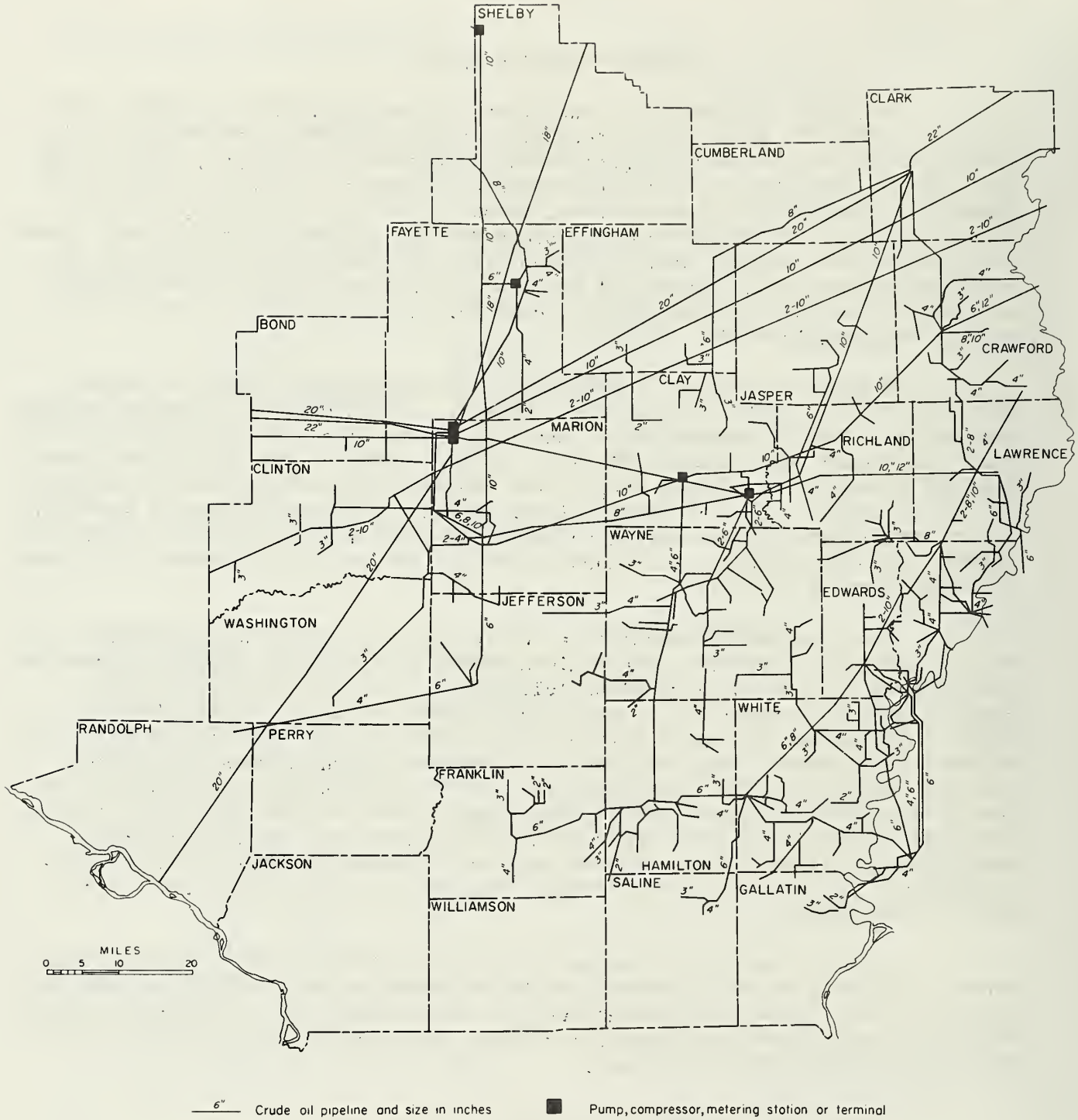


Fig. 24 - Crude oil pipelines in the Southeastern Illinois Region.

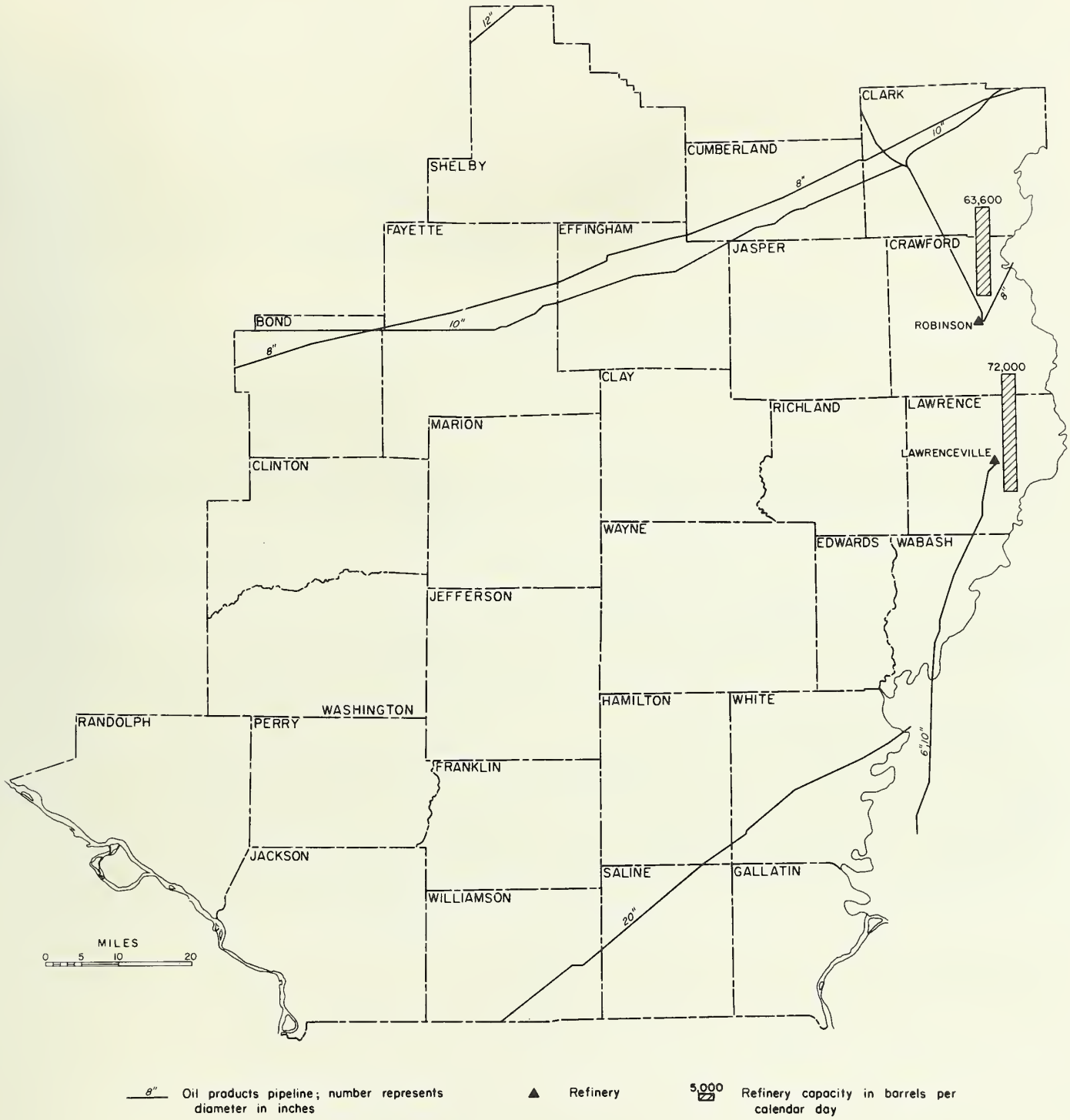


Fig. 25 - Crude oil refineries and products pipelines in the Southeastern Illinois Region.

Fig. 26 - Natural gas pipelines in the Southeastern Illinois Region.

known as coal "brasses," is removed during the process of cleaning coal, but as there is no demand for it, it is discarded. In 1952 when sulfur was scarce on the world market, Voskuil (1952) prepared a study on the market outlook for sulfur recovered from coal. However, during the late 1950's and early 1960's sulfur production tended to exceed consumption, and by 1961 and 1962, production outstripped consumption by a million tons, depressing prices to $20 per ton. By 1965 a new shortage had developed, and prices went up to $31 per ton (Mining Journal, 1966, p. 23). If the shortage continues and prices are forced upward, it may become economic to exploit such alternative sources of sulfur as coal brasses. However, present methods of manufacturing sulfuric acid from pyrite require that the carbon content of the pyrite be low. As it is difficult to beneficiate pyrite extracted from coal to meet these low-carbon specifications, this technical problem must be solved before the coal brasses can be considered as an economic alternative source of sulfur.

PROCESSING AND TRANSPORTATION FACILITIES

Metals

Secondary zinc smelters are operated at Beckemeyer in Clinton County and at Sandoval in Marion County (U. S. Bur. Mines, 1963, p. 1320).

Oil and Gas

In addition to production facilities, the Southeastern Illinois Region has transportation and processing facilities for oil and gas. The location of crude oil pipelines within the region are shown in figure 24. Some of the oil carried by these lines originates outside of the state.

The location and capacities of the crude oil refineries and the location of refined petroleum products pipelines are shown in figure 25. As of April 1965 (Oil and Gas Journal, 1965), the two refineries in the Southeastern Illinois Region—one at Lawrenceville and one at Robinson—possessed 20.9 percent of the state's refining capacity as measured in barrels per calendar day. The location and size of natural gas pipelines in the region are shown in figure 26.

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